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(56) References cited:
DE-A- 3 807 225
DE-A- 3 842 401
US-A- 4 385 853
US-A- 4 408 935

- **PATENT ABSTRACTS OF JAPAN vol. 16, no. 346 (M-1286)27 July 1992 & JP-A-41 05 811 (MIYANAGA KK)**

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Description

The present invention relates to a hole cutter or core drill for cutting a relatively large hole in a relatively thick plate of metal such as steel.

The applicant's U.S. Patent No. 4,408,935 dated Oct. II, 1983, on which is based the preamble of claim 1, shows a metal borer of this general type including a shank 4, a cylindrical blade I and a centering pin 8, which is supported by the shank and urged by a spring to normally project forwardly from the blade. When in use, first, a thick metal plate has a small centre recess formed by a separate drill, and the pointed end of pin 8 is located in the recess. Then, the shank 4 is rotated and pressed forwardly so that the blade I cuts a hole around the recess, while the pin 8 retracts into the shank 4. If the centre recess is too shallow or the spring is too weak, the pin 8 may jump out of the recess during the operation, thus losing the centering action.

The applicant's Japanese Patent Early Publication No. H.4-I05,8II dated April 7, 1992 shows another hole cutter including a shank 2, a cylindrical blade 6 and a centre drill 10, which is fixed to the shank 2 and projects forwardly from the blade 6. First, the drill 10 bores a centre bore in a metal plate. If the plate is thick, the centre boring may continue after the blade 6 begins cutting, and consequently add a resistance to the cutting resistance of the blade 6, thus lowering the operation efficiency.

It is a general object of the present invention to provide a hole cutter having both a centre drill for initially boring a sufficiently deep centre bore in a metal plate, and a centring pin for insertion into the bore.

A hole cutter according to this invention comprises:

a spindle having a rearward end shaped to be engaged and rotated by a drive machine, the spindle further having a front end and an axial centre bore,

a cylindrical blade for attachment to the front end of the spindle,

a centring pin supported in telescopic relation within the centre bore of the spindle, the pin having means for engaging with the spindle to limit the forward movement of the pin relative to the spindle, and

a spring (28) supported in the centre bore and urging the pin forwardly relative to the spindle so that a front portion of the pin normally projects forwardly from the spindle and the blade,

characterised in that a centre drill is capable of attachment to the front end of the spindle to project forwardly from the blade the drill having an axial centre bore which receives the front portion of the pin, the drill further having a bit attached to its front end, and being detachable from the spindle to expose the front portion of the pin.

A preferred embodiment of the invention is shown in the accompanying drawings, wherein:

Fig. I is an exploded perspective view of a hole cutter embodying the invention;

Fig. 2 is a side view in axial section of the cutter;

Fig. 3 is a side view of part of the cutter; and

Fig. 4 is a sectional view along line 4-4 of Fig. 2, but with parts angularly moved somewhat.

With reference to the drawings, particularly to Figs. 1 and 2, the hole cutter includes a spindle 10 having a shank 12 at its rear end, which can be joined by a chuck to a drive shaft of a drill press (not shown) to be rotated and pressed forwardly.

The spindle 10 has an axial centre bore 14, which ends in an inner thread 16, and another axial centre bore 18, which is connected to the bore 14 and is smaller in diameter than it.

A centering pin 20 has a rear flange 22 in the bore 14 and a pointed front end 24, and can slide axially through the bores 14 and 18. The forward movement of the pin 20 is limited by the flange 22 engaging with the front end of larger bore 14. A rear stop screw 26 engages with the thread 16. A spring 28 is compressed between the screw 26 and the pin flange 22 and urges the pin 20 forwardly.

The spindle 10 has a front end portion 30 smaller in diameter than the middle portion (between the shank 12 and the end portion 30), a peripheral step 32 being formed between the middle portion and the portion 30. The front end portion 30 has three notches 34 (Figs. 3 and 4) at angularly regular intervals in its peripheral surface. Each notch 34 is connected and axially aligned with a plane or flat surface 36 in the periphery at the front end of portion 30 (see Fig. 1).

The front portion 30 also has a radial hole 38 diametrically through it, one end of the hole opening in the bottom of one notch 34 and being narrowed relative to the other end. As best shown in Fig. 4, the narrow end of hole 38 is offset angularly from the centre of the notch 34, and divides the bottom of this notch into a long side 34a and a short side 34b.

A ball 40 is placed in the narrowed end of the hole 38 and is urged outwardly by a spring 42 compressed between the ball 40 and the pin 20 to normally project a portion of the ball from the narrowed end of the hole and a smaller portion beyond the plane surface 36 (see Fig. 2).

A cylindrical blade 44 (Fig. 1) has a number of teeth 46 at its forward end, and it has three round bumps or inner projections 48 (Figs. 2 and 4) at angularly regular intervals adjacent its rear end. The projections 48 transmit the torque from the spindle 10 to the blade 44.

By axially aligning one projection 48 with the long side 34a of the notch associated with the hole 38, the blade 44 can be slid axially on the front end spindle portion 30 until it contacts the step 32 (see Fig. 2) and the projections 48 reach the notches 34. Then, by manually rotating the blade 44 clockwise as seen in Fig. 4 relative to the spindle 10, one of the projections 48 snaps over the ball 40 to the short side 34b of the notch (Fig. 4) to normally fix the blade 44 to the spindle 10 both axially in the upward direction and angularly in the counter-clockwise direction.

The front spindle portion 30 includes two legs 50 (Figs. 1 and 3) which project downwardly from its bottom end, each leg having inner and outer cylindrical surfaces 52 and 54. Each outer surface 54 has a peripheral groove 56 for receiving and engaging with a split ring 58.

A centre drill 60 includes a tubular part 61 and a bit 62. The part 61 has a centre bore 64 that is slightly larger than the centering pin 20. The axial centre bore 64 has the same diameter as the smaller bore 18 of spindle 10, so that a front portion of the pin 20 can axially slide in the bores 18 and 64.

The rear end of the drill 60 has two recesses 66 (Figs. 1 and 3), each being in driving engagement with one spindle leg 50, and two aligned peripheral grooves 68 for engagement with the split ring 58 (see Fig. 3). The legs and the ring normally keep the drill 60 in engagement with the spindle 10.

The bit 62 is secured to the tubular part 61. The bit 62 extends into the lower end of the bore 64 of the part 61 and they are secured together by crimping a portion 63 of the part 61 into a dimple in the bit 62.

In operation, with the blade 44 and the drill 60 engaging with the spindle 10 as shown in Fig. 2, the spindle 10 is rotated clockwise as seen from the rear and pressed forwardly, so that the drill bit 62 bores a center bore at a predetermined point in a thick metal plate. When a predetermined depth of the centre bore is reached (before the bottom end of the part 61 engages the metal plate), the operation is stopped and the cutter tool is pulled back from the plate.

Then, the centre drill 60 is pulled forwardly against the force of split ring 58 to disengage the drill 60 from the spindle 10. It will be noted that the centering pin 20 has substantially the same diameter as the bit 62. Thereafter, the thus exposed pointed front end 24 of the centering pin 20 is inserted into the earlier formed centre bore, and the spindle 10 is again rotated and pressed so that the blade 44 cuts a hole around the centre bore in the plate. During this cutting, the pin 20 is held in the centre bore securely without springing out because it is inserted into the bore substantially to the full depth of the previously drilled bore.

Claims

1. A hole cutter comprising:

   a spindle (10) having a rearward end (12) shaped to be engaged and rotated by a drive machine, the spindle (10) further having a front end (30) and an axial centre bore (14, 18),

   a cylindrical blade (44) for attachment to the front end (30) of the spindle (10),

   a centring pin (20) supported in telescopic relation within the centre bore (14,18) of the spindle (10), the pin (20) having means (22) for engaging with the spindle (10) to limit the forward movement of the pin (20) relative to the spindle (10), and

   a spring (28) supported in the centre bore and urging the pin (20) forwardly relative to the spindle (10) so that a front portion of the pin (20) normally projects forwardly from the spindle (10) and the blade (44),

   characterised in that a centre drill (60) is capable of attachment to the front end (30) of the spindle (10) to project forwardly from the blade (44) the drill (60) having an axial centre bore (64) which receives the front portion of the pin (20), the drill (60) further having a bit (62) attached to its front end, and being detachable from the spindle (10) to expose the front portion of the pin (20).

2. A hole cutter as claimed in Claim 1 in which the axial centre bore in the spindle (10) comprises a wider bore (14) and a narrow bore (18) positioned adjacent the front end (30), and the centring pin (20) has a rear flange (22) which engages the junction between the two bores (14, 18) to limit the forward movement of the pin (20) relative to the spindle (10).

3. A hole cutter as claimed in Claim 1 or Claim 2 in which the cylindrical blade (44) is attached to the front end (30) of the spindle (10) by means of projections (48) engaging with notches (34) on the spindle, and a resiliently mounted ball (40) is provided over which one of the said projections (48) is a snap fit.

4. A hole cutter as claimed in any preceding claims in which the centre drill (60) is detachably connected to the spindle (10) by spindle legs (50) projecting from the front end (30) of the spindle (10) which engage in recesses (66) in the rear end of the drill (60), and a split ring (58) engaged in aligned grooves (56, 68) in the legs (50) and drill (60).

Patentansprüche

1. Lochschneider, umfassend:

   eine Spindel (10) mit einem rückwärtigen Ende (12), das so geformt ist, daß es in Eingriff kommt mit einem Antrieb und durch diesen rotiert, wobei die Spindel (10) weiterhin eine Stirnseite (30) aufweist und ein axiale Mittenbohrung (14, 18),

   ein zylindrisches Blatt (44) zur Befestigung an der Stirnseite (30) der Spindel (10),

   einen Zentrierstift (20), der ausschiebbar in der Mittenbohrung (14, 18) der Spindel (10) gehalten wird, wobei der Stift (20) Mittel (22) aufweist, die in Eingriff mit der Spindel (10) kommen, um die Vorwärtsbewegung des Stifts (20) relativ zur Spindel (10) zu begrenzen, und

   eine Feder (28), die in der Mittenbohrung gehalten wird und den Stift (20) nach vorne relativ zur Spindel (10) zwingt, so daß der Vorderbereich des Stiftes (20) üblicherweise nach vorne aus der Spindel (10) und dem Blatt (44) vorspringt,

   dadurch gekennzeichnet,

   daß ein Mittenbohrer (60) an die Stirnseite (30) der

Spindel (10) angebracht werden kann, um nach vorne aus dem Blatt vorzuspringen, wobei der Bohrer (60) eine axiale Mittenbohrung aufweist, die den Vorderbereich des Stiftes (20) aufnimmt, wobei der Bohrer (60) weiterhin einen Bohreinsatz (62) aufweist, der an seinem vorderen Ende befestigt ist, und der abnehmbar von der Spindel (10) ist, um den Vorderbereich des Stiftes (20) freizulegen.

2. Lochschneider nach Anspruch 1, wobei die axiale Mittenbohrung in der Spindel (10) eine breitere Bohrung (14) umfaßt und eine schmale Bohrung (18), die an die Stirnseite (30) angrenzt, wobei der Zentralstift (20) einen hinteren Flansch (22) aufweist, das mit der Verbindung zwischen den zwei Bohrungen (14, 18) in Eingriff kommt, um die Vorwärtsbewegung des Stiftes (20) in Relation zu der Spindel (10) zu begrenzen.

3. Lochschneider nach Anspruch 1 oder 2, wobei das zylindrische Blatt (44) an der Stirnseite (30) der Spindel (10) durch Vorsprungmittel (48) befestigt ist, die mit Aussparungen (34) an der Spindel in Eingriff kommen, und wobei eine elastisch angebrachte Kugel (40) vorgesehen ist über denjenigen von den Vorsprüngen (48), der eine Einschnappfassung ist.

4. Lochschneider nach einem der vorhergehenden Ansprüche, wobei der Mittenbohrer (60) lösbar mit der Spindel (10) verbunden ist mittels von der Stirnseite (30) der Spindel (10) herausragender Spindelbeine (50), die in Eingriff mit Ausnehmungen (66) auf der Rückseite des Bohrers (60) kommen, und wobei ein Spaltring (58) in Eingriff mit ausgerichteten Vertiefungen (56, 68) in den Beinen (50) und dem Bohrer (60) ist.

Revendications

1. Fraise à aléser, comprenant :

une broche (10) ayant une extrémité (12) tournée vers l'arrière et dont la configuration lui permet de coopérer avec une machine d'entraînement afin qu'elle tourne, la broche (10) ayant en outre une extrémité avant (30) et un trou central axial (14, 18),

une lame cylindrique (44) destinée à être fixée à l'extrémité avant (30) de la broche (10),

une tige de centrage (20) supportée de manière télescopique dans le trou central (14, 18) de la broche (10), la tige (20) comprenant un dispositif (22) de coopération avec la broche (10) afin que le mouvement d'avance de la tige (20) par rapport à la broche (10) soit limité, et

un ressort (28) supporté dans le trou central et rappelant la tige (20) vers l'avant par rapport à la broche (10) de manière qu'une partie avant de la tige (20) dépasse normalement en avant de la broche (10) et de la lame (44), et

caractérisée en ce qu'un foret central (60) est destiné à être fixé à l'extrémité avant (30) de la broche (10) afin qu'il dépasse en avant de la lame (44), le foret (60) ayant un trou axial central (64) qui loge la partie avant de la tige (20), le foret (60) ayant en outre une mèche (62) fixée à son extrémité avant et pouvant être séparée de la broche (10) afin que la partie avant de la tige (20) soit exposée.

2. Fraise à aléser selon la revendication 1, dans laquelle le trou axial central formé dans la broche (10) comporte un trou relativement large (14) et un trou relativement étroit (18) adjacent à l'extrémité avant (30), et la tige de centrage (20) a un flasque arrière (22) qui est au contact du raccord des deux trous (14, 18) afin qu'il limite l'avance de la tige (20) par rapport à la broche (10).

3. Fraise à aléser selon la revendication 1 ou 2, dans laquelle la lame cylindrique (44) est fixée à l'extrémité avant (30) de la broche (10) par des saillies (48) pénétrant dans des encoches (34) formées sur la broche, et une bille (40) montée élastiquement est disposée de manière que l'une des saillies (48) s'enclenche élastiquement sur la bille.

4. Fraise à aléser selon l'une quelconque des revendications précédentes, dans laquelle le foret central (60) est raccordé de façon temporaire à la broche (10) par des bras (50) de la broche dépassant de l'extrémité avant (30) de la broche (10) et qui pénètrent dans des cavités (66) de l'extrémité arrière du foret (60), et une bague élastique (58) coopérant avec des gorges alignées (56, 68) des bras (50) et du foret (60).

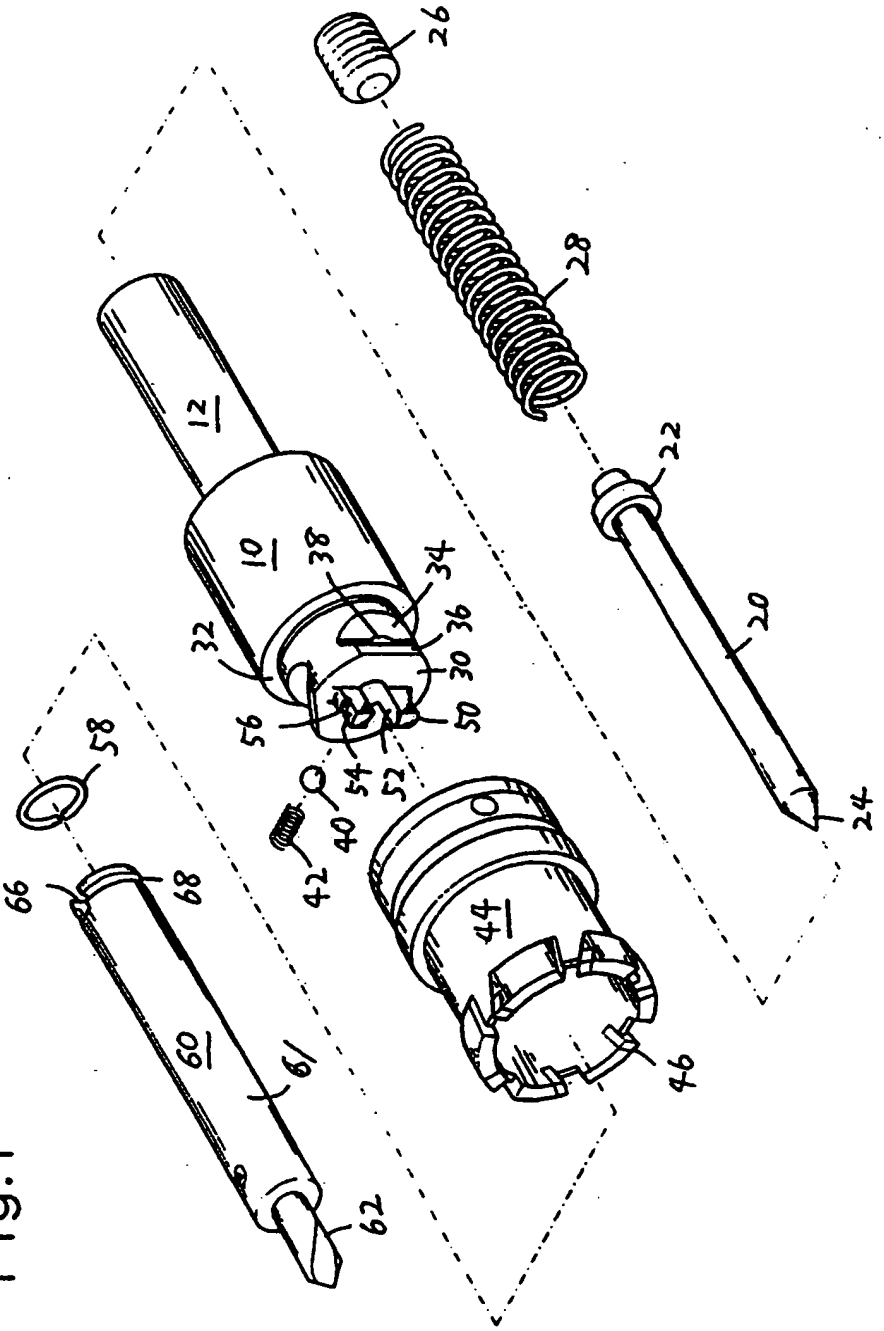
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Fig.1

Fig.2

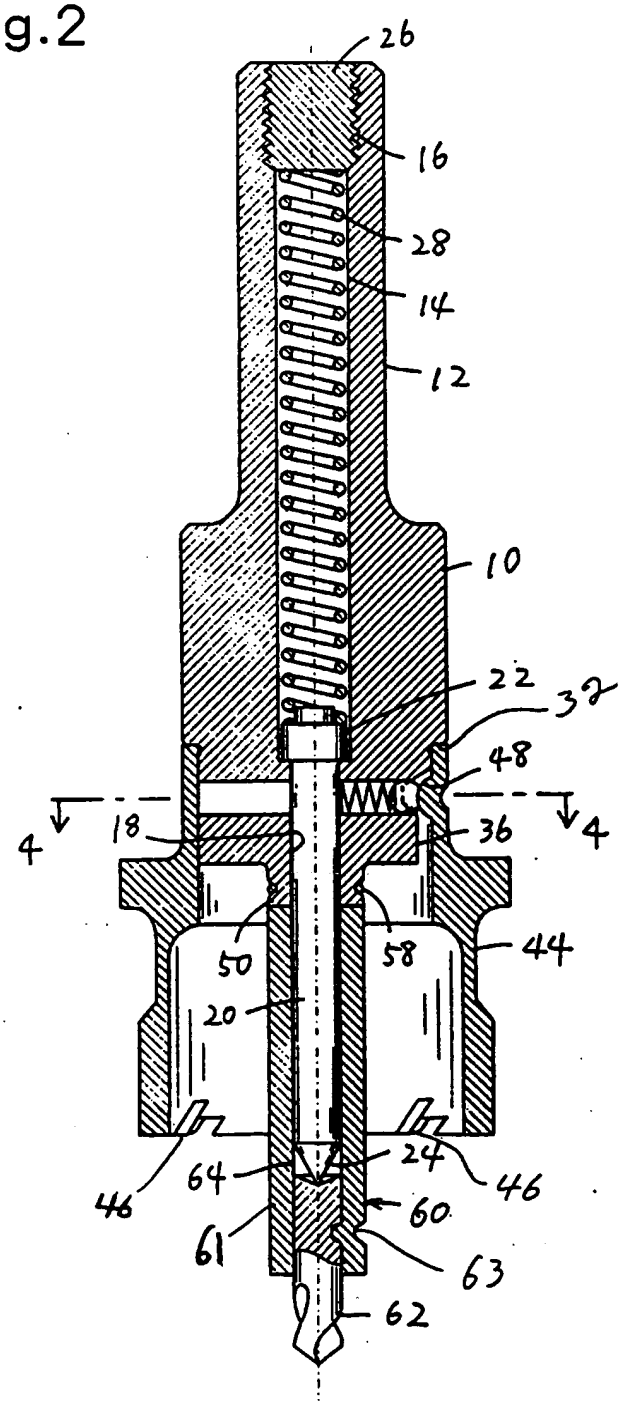

Fig.3

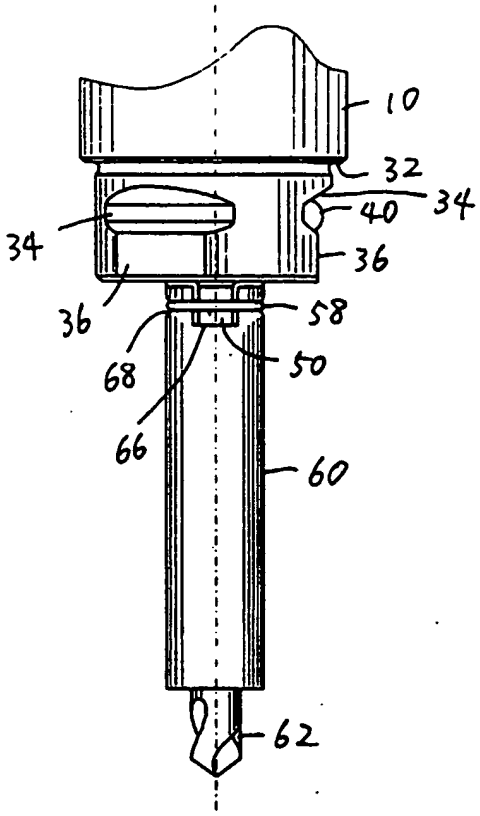
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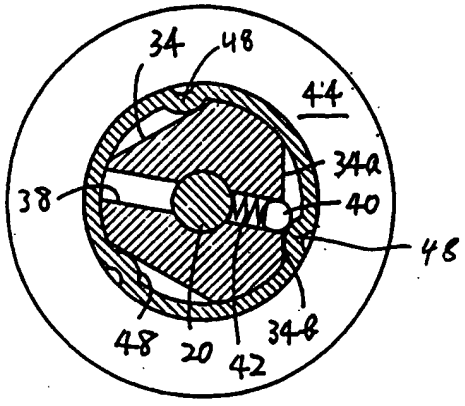
Fig.4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